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Italian guidelines for energy performance of cultural heritage and historical buildings: the case study of the Sassi of Matera

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Abstract

The Sassi of Matera are a unique example in the world of rock settlements, developed from natural caves carved into the rock and molded into increasingly complex structures inside two large natural amphitheaters. Research focuses on the compatibility of the energy efficiency measures applied in Sassi buildings with the recent MiBACT guidelines on "Energy efficiency improvements in cultural heritage" and AiCARR guidelines on "Energy efficiency of historical buildings". The paper aims to analyze energy and environmental performance of different building typologies and monuments of the Sassi site.

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1. Introduction

Energy efficiency improvement is one of the main measures promoted by the Kyoto Protocol. In this direction, several European Directives have been encouraged for the development of renewable energy sources and implementation of energy efficiency, such as Directive 2009/28/EC and Directive 2010/31/EU [1, 2].

In Italy, the recent renovation of the Legislative Decree 19 August 2005, n. 192 "Implementation of Directive 2002/91/EC on the energy performance of buildings", operated by Law 90/2013, excludes its application to cultural

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heritage when the observance of requirements imply a substantial alteration of their character or appearance, with particular reference to historical profiles and artistic landscapes [3].

In June 2015, three important measures have also been issued in order to take an important step towards the Nearly Zero Energy Buildings. The first decree refers to the new method for calculating the energy performance and the new minimum efficiency requirements for new buildings and those undergoing renovation [4]. A second decree is aimed at adapting technical report schemes of the project to the new regulatory framework, depending on the different types of works: new buildings, major renovations, energy retrofits [5]. With the third decree, finally, the guidelines for the certification of the energy performance of buildings (EPA) have been updated [6]. These decrees do not introduce innovations regarding the respect of the energy requirements of historic buildings.

On 29 October, 2015, the Ministry of Cultural Heritage and Activities and Tourism (Italy) published specific guidelines for energy performance of cultural heritage [7]. These guidelines provide guidance for the evaluation and improvement of the energy performance of the protected cultural heritage, with reference to the Italian laws on savings and energy efficiency of buildings.

As stated in the Italian guidelines, the energy saving related to the reduction of fuel consumption and of atmospheric emissions of pollutants, is a priority for the preservation of the environment.

In recent years, moreover, the reduction of public spending makes it necessary to reduce energy costs incurred for the running of properties managed. For this reason the knowledge of energy and environmental capacity of historical buildings is important to preserve not only quality and comfort of indoor environments but also to adopt the best intervention strategies for improving energy performance.

To attribute an objective judgment to the environmental quality one should know the physical parameters that influence comfort, energy consumption of a building and healthiness of the environment.

In the evaluation of energy performance, a number of parameters must be taken into account:

- climatic aspects of the locality;
- level of thermal insulation;
- existence of its own energy generation systems;
- technical characteristics and installation of the plants;
- microclimate of indoor environments.

The overall energy performance of the building is expressed through the global energy performance index EP_{gl} (1), which takes into account the non-renewable primary energy demand for winter heating and summer air-conditioning ($EP_{H,nren}$ and $EP_{C,nren}$), for the production of domestic hot water ($EP_{W,nren}$), ventilation ($EP_{V,nren}$) and, in the case of the non-residential sector, for artificial lighting ($EP_{L,nren}$) and for the transport of persons or things ($EP_{T,nren}$).

$$EP_{gl,nren} = EP_{H,nren} + EP_{C,nren} + EP_{W,nren} + EP_{V,nren} + EP_{L,nren} + EP_{R,nren} \quad (1)$$

To determine the building energy class, the EPA preparation is performed as follows:

- determining the value $EP_{gl,nren,ref,standards}$ (2019/21), which is the index of non-renewable global energy performance for a referred building according to [4];
- calculating the value of $EP_{gl,\,nren}$ for the building and its energy class as identified in the table 2 of Annex 1. Cap. 5 of [4].

It must perform the assessment of the energy performance ante and post-operam.

1. Italian guidelines for energy performance of cultural heritage

One of the essential measures, highlighted by MiBACT guidelines, is to ensure the Indoor Environmental Quality improvement for historical architecture in order to preserve their identity and cultural heritage.